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A quarterly publication of the NASA Scientific and Technical Information (STI) Program produced by the NASA Center for AeroSpace Information (CASI) for the users of our information products and services.

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Featured Articles

Outreach Adventures

The NASA Center for AeroSpace Information (CASI) Outreach Specialists Michelle Mariano, Kurt McIntyre, and Chris Stark took flight to the far reaches of NASA this summer with visits to the NASA Ames Research Center at Moffett Field, California, and to the White Sands Test Facility near Las Cruces, New Mexico. Charged with the task of training staff at the NASA field centers on the STI database and with the opportunity of opening up lines of communications, Mariano and McIntyre spent August 10 and 11, 2004, at Ames, while Stark stayed at White Sands, August 17 and 18, 2004.

Ames Research Center

During their visit in sunny California, Mariano and McIntyre were welcomed by the friendly staff of the Ames Library. Together, they invaded the cafeteria at lunchtime armed with flyers and a computer to spread the word to the Ames community about the NASA STI database. Later on, they conducted an in-depth demonstration of the database to a room full of eager listeners. Attendees included the library staff, many scientists and engineers, and the Assistant Center Director for Technology, Peter Friedland. Mariano and McIntyre brought back to CASI positive and constructive feedback from these sessions that will enhance the database for all users.

Thanks to the tremendous support they received from the Ames Library staff, Mariano and McIntyre have deemed this trip a success!

White Sands Test Facility

Stark spent 2 days at the White Sands and thoroughly enjoyed the interaction with the NASA employees and contractors alike. The trip would not have been possible without the efforts of Moira Romansky and her team in the Technology Information Section (TIS). What terrific hosts!

White Sands' primary mission is to provide support to the Space Shuttle and Space Station Programs. Since its inception in 1962, White Sands has been a preeminent resource for testing and evaluating potentially hazardous materials, space flight components, and rocket propulsion systems-- it's no accident that WSTF is located east of the city of Las Cruces. For in the rare event of a leakage of hazardous material (so rare it's never happened!), the prevailing westerly winds would carry the substance away from the city.

The meeting between CASI's Stark and the White SandsTechnology Information Section (TIS) staff provided a chance for both to coordinate in promoting similar efforts. The mission of the TIS is to "provide customers with responsive, team-based support for producing quality scientific and technical publications." CASI's goals are to acquire the White Sands publications and make them available in the database, as well as provide critical data to researchers preparing those publications.

During the 2-day visit, Stark conducted four database training sessions at White Sands to the Laboratory, the Environmental/Administration, the Propulsion, and the Technology Information sections. Comments from the participants were quite favorable.

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Spinoff 2004 Coming Soon!

The highly anticipated release of *Spinoff* 2004 is scheduled for later this month. To receive a complimentary copy of the new issue upon release, please contact the National Technology Transfer Center at 1-800-678-6882 or go to the online order form at http://www.sti.nasa.gov/tto/spin_order_form.html. Soon after the magazine release, *Spinoff* 2004 will also be available on an interactive CD-ROM, complete with Web links and streaming audio and video. Please check the *Spinoff* Web site (http://www.sti.nasa.gov/tto/) for more information on the CD-ROM release date.

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Focus On ... The Cassini-Huygens Mission

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The Cassini-Huygens spacecraft has begun its 4-year tour of Saturn. Since its launch from Kennedy Space Center on October 15, 1997, the spacecraft has followed an intricate trajectory and is now in orbit around the giant ringed planet. During the next 4 years, its instruments will gather data on many features of Saturn, including its rings, its atmosphere, and its moons. Titan is the moon of particular interest to scientists, since its unique environment and thick atmosphere may resemble that of Earth some several billion years ago. In December 2004, the Huygens probe is scheduled to separate from the Cassini Orbiter and drop to the surface of Titan, collecting data on the moon's atmosphere and images of its surface and sending them to the Cassini Orbiter overhead for playback to Earth.

Cassini-Huygens is a massive spacecraft loaded with an array of powerful instruments and sensors for exploration of Saturn's vast system. Its long journey has already provided new data about Jupiter, which it flew by in 2000. More recently, scientists have been excited by closer looks at the moon Phoebe and the rings themselves than ever before. Two new Saturnian moons are among the most recent discoveries.

The Cassini-Huygens mission is a collaboration of NASA, the European Space Agency, and the Italian Space Agency. More than 250 scientists worldwide will study the data collected.

The citations below provide a sample of recently published information found in the NTRS: NASA Technical Reports Server. Some documents are available in full-text Portable Document Format (PDF) files that you can download free of charge, while others can be purchased through the STI Help Desk at 301-621-0390 or help@sti.nasa.gov. Please use the document identification numbers listed below when contacting the Help Desk. You can also keep up to date on this topic by checking *Scientific and Technical Aerospace Reports (STAR)*, a biweekly abstract journal, in Category 18 – Spacecraft Design, Testing and Performance and in Category 91 – Lunar and Planetary Science and Exploration. You can find *STAR* on the STI web site at www.sti.nasa.gov.

Dayton, James A., Jr.; Wilson, Jeffrey D.; Kory, Carol L.; Computer Analysis of Spectrum Anomaly in 32-GHz Traveling-Wave Tube for Cassini Mission; 19990024827

Dodd, Suzanne; Gustavson, Robert; Flying Cassini with Virtual Operations Teams; 20000054880

Hughes, William O.; McNelis, Anne M.; Himelblau, Harry; Investigation of Acoustic Fields for the Cassini Spacecraft: Reverberant Versus Launch Environments; 20000120397

Lakew, Brook; Brasunas, J. C.; High- and Mid-temperature Superconducting Sensors for Far IR/Sub-mm Applications in Space; 20040068217

Mudgway, Douglas J.; Launius, Roger; Uplink-Downlink: A History of the Deep Space Network, 1957-1997; 20020033033

Sittler, E.; Johnson, R. E.; Jurac, S.; Richardson, J.; McGrath, M.; Crary, F.; Young, D.; Nordholt, J. E.; Pickup Ions at Dione and Enceladus; 20020079428

Spilker, Linda J.; Passage to a Ringed World: The Cassini-Huygens Mission to Saturn and Titan; 20040052869

Thronson, Harley; Enabling Telescopes of the Future: Long-Range Technology Investing; 20040074312

Wishnow, E. H.; Gush, H. P.; Halpern, M.; Ozier, I.; Submillimeter Spectra of Low Temperature Gases and Mixtures; 20030058895

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From the Users

NTRS: NASA Technical Reports Server

A new feature of the NTRS: NASA Technical Reports Server is the display of NASA Accession Numbers, also known as N numbers. These numbers were used before 1998 to identify NASA-distributed microfiche, and many libraries filed the fiche by the numbers. The appearance of the N number in the NTRS record will make it easier for librarians and library customers to determine whether a document is available locally. Many NTRS users have requested that the Accession Number be displayed and will find this new feature valuable.

You can also search by the Accession Number by entering it in the text box on the Simple Search screen or in the box labeled “Accession ID” on the Advanced Search screen.

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Did You Know?

The Internet Archive Web site http://www.archive.org, also called the Wayback Machine, includes many NASA pages. If you are looking for an older version of a NASA site or document, you may find it helpful. Search tips and other information about the project are in the FAQ at the following address: http://www.archive.org/about/faqs.php

According to the Web site, “The Internet Archive is a 501(c) (3) public nonprofit that was founded to build an ‘Internet library,’ with the purpose of offering permanent access for researchers, historians, and scholars to historical collections that exist in digital format.” For more, see this Web site.

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From the STI Program Office

NASA History Books Available From CASI

The NASA History Office and the NASA Center for AeroSpace Information (CASI) have reached an agreement to make some of the many books available from the History Office also available through CASI. The books come in original hardbound or paperback versions. CASI also sends these books to the Government Printing Office and the National Technical Information Service. CASI's first selection is a book edited by John M. Logsdon, with Stephen J. Garber, Roger D. Launius, and Ray A. Williamson, entitled, "*Exploring the Unknown, Volume VI: Space and Earth Science*." The book is available in original hardbound version and may be ordered online at: https://www.sti.nasa.gov/cgi-bin/ordersti.pl or by contacting CASI by telephone at 301-621-0390 or by email at help@sti.nasa.gov. The History Office publishes numerous books to document and preserve NASA's remarkable legacy and serves two key functions: fulfilling the mandate of the 1958 "Space Act" calling for NASA to disseminate aerospace information as widely as possible, and helping NASA managers understand and thus benefit from the study of past accomplishments and difficulties. For more information on the NASA History Office and its publications, visit the Web site at: http://history.nasa.gov.

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Current Topics

Ejection of the Huygens Probe

In December 2004, Cassini will eject the Huygens probe. After its 22-day coast, the cone-shaped probe will descend into Titan's cloudy atmosphere. Three sets of parachutes will deploy to slow the probe and to provide a stable platform for scientific measurements. Instruments on board will collect information about the atmosphere's chemical composition and the clouds surrounding Titan. The data will be radioed to the Cassini orbiter, which will then relay the data to Earth.

About 2 hours after entering Titan's atmosphere, the probe will land near the moon's equator. If Huygens survives the impact, the probe might be able to communicate with the spacecraft for a few minutes after landing on the frozen surface of Titan. Huygens will be the furthest human-made object ever to land on a celestial body.

B. Kazeminejad and D.H. Atkinson, “The ESA Huygens Probe Entry and Descent Trajectory Reconstruction,” *Proc. Int. Workshop on Planetary Probe Atmospheric Entry and Descent Trajectory Analysis and Science*, Lisbon, 6-9 October 2003. ESA SP-544, pp. 137-149.

Jean-Pierre Lebreton and Dennis L. Matson, “The Huygens Mission to Titan: Overview and Status,” *Proc. Int. Workshop on Planetary Probe Atmospheric Entry and Descent Trajectory Analysis and Science*, Lisbon, 6-9 October 2003. ESA SP-544, pp. 21-30.

M. Fulchignoni, et al., “Huygens: Science, Payload, and Mission,” ESA, SP-1177, 177-195, 1997.

Conference Proceedings of the European Space Agency’s *Titan: From Discovery to Encounter*. http://sci2.esa.int/huygens/conference/.

NASA History

GReat Images in NASA (GRIN) is a collection of over a thousand images of significant historical interest scanned at high-resolution in several sizes. The following is a sample of great Saturn images in NASA history.

Pioneer 11 was launched on April 5, 1973, and was the first spacecraft to visit Saturn. The irregularities in ring silhouette and shadow are due to technical anomalies in the preliminary data later corrected. Looking at the rings from left to right, the ring area begins with the outer A Ring; the Encke Division; the inner A Ring; Cassini Division; the B Ring; the C Ring; and the innermost area where the D Ring would be. The image was made by Pioneer Saturn on Wednesday, August 26, 1979, and received on Earth at 3:19 pm PDT. Pioneer was, at that time, 1,768,422 miles (2,846,000 kilometers) from Saturn. The image was produced by computer at the University of Arizona and managed by NASA's Ames Research Center.

Two Voyager spacecraft were launched in 1977 to explore the outer planets and some of their satellites. A prototype Voyager spacecraft is shown at NASA's Jet Propulsion Laboratory in Pasadena, California, as it successfully passed vibration tests, which simulated the expected launch environment. The large parabolic antenna at the top is 3.7 meters in diameter and was used at both S-band and X-band radio frequencies for communicating with Earth over the great distances from the outer planets. The spacecraft received electrical power from three nuclear power sources (lower left). The shiny cylinder on the left side under the antenna contained a folded boom, which extended after launch to hold a magnetometer instrument 13 meters away from the body of the spacecraft. The truss-like structure on the right side is the stowed instrument boom, which supported three science instruments and a scan platform. The scan platform allowed the accurate pointing of two cameras and three other science instruments at Jupiter, Saturn, Uranus, the moons of each of those planets, and Neptune.

A picture of the Earth and Moon in a single frame, the first of its kind ever taken by a spacecraft, was recorded September 18, 1977, by NASA’s Voyager 1 when it was 7.25 million miles (11.66 million kilometers) from Earth. The Moon is at the top of the picture and beyond the Earth as viewed by Voyager. In the picture are eastern Asia, the western Pacific Ocean, and part of the Arctic. Voyager 1 was directly above Mt. Everest (on the night side of the planet at 25 degrees north latitude) when the picture was taken. The photo was made from three images taken through color filters, and then processed by the Image Processing Lab at Jet Propulsion Laboratory (JPL). Because the Earth is many times brighter than the Moon, the Moon was artificially brightened by a factor of three relative to the Earth by computer enhancement so that both bodies would show clearly in the prints. Voyager 1 was launched September 5, 1977 and JPL is responsible for the Voyager mission.

Voyager 2 was launched August 20, 1977, 16 days before Voyager 1, aboard a Titan-Centaur rocket. Their different flight trajectories caused Voyager 2 to arrive at Jupiter 4 months later than Voyager 1, thus explaining their numbering. The initial mission plan for Voyager 2 specified visits only to Jupiter and Saturn. The plan was augmented in 1981 to include a visit to Uranus, and again in 1985 to include a flyby of Neptune. After completing the tour of the outer planets in 1989, the Voyager spacecraft began exploring interstellar space. The Voyager mission has been managed by NASA's Office of Space Science and the Jet Propulsion Laboratory.

A Voyager 2 view, focusing on Saturn's C Ring (and to a lesser extent, the B Ring at top and left) was compiled from three separate images taken through ultraviolet, clear, and green filters. On August 23, 1981, when it acquired these frames, Voyager 2 was 1.7 million miles (2.7 million kilometers) from the planet. In general, C Ring material is very bland and gray, the color of dirty ice. Color differences between this ring and the B Ring indicate differing surface compositions for the material composing these complex structures. More than 60 bright and dark ringlets are evident here; the small, blank squares are caused by the removal of reseau (reference) marks during processing.

A 7-year journey to the ringed planet Saturn began with the liftoff of a Titan IVB/Centaur carrying the Cassini orbiter and its attached Huygens probe. Launch occurred at 4:43 a.m. EDT, October 15, 1997 from Launch Complex 40 on Cape Canaveral Air Station. After a 2.2-billion mile journey that will include two swing-bys of Venus and one of Earth to gain additional velocity, the two-story tall spacecraft arrived at Saturn on June 30, 2004. The orbiter will circle the planet for 4 years, its complement of 12 scientific instruments gathering data about Saturn's atmosphere, rings, and magnetosphere, and conducting close-up observations of the Saturnian moons. Huygens, with a separate suite of six science instruments, will separate from Cassini to fly on a ballistic trajectory toward Titan, the only celestial body besides Earth to have an atmosphere rich in nitrogen. Scientists are eager to study further this chemical similarity in hopes of learning more about the origins of our own planet Earth. Huygens will provide the first direct sampling of Titan's atmospheric chemistry and the first detailed photographs of its surface. The Cassini mission is an international effort involving NASA, the European Space Agency (ESA), and the Italian Space Agency, Agenzia Spaziale Italiana (ASI). The Jet Propulsion Laboratory manages the U.S. contribution to the mission for NASA's Office of Space Science, Washington, DC. The major U.S. contractor is Lockheed Martin, which provided the launch vehicle and upper stage, spacecraft propulsion module, and radioisotope thermoelectric generators that will provide power for the spacecraft. The Titan IV/Centaur is a U.S. Air Force launch vehicle, and launch operations were managed by the 45th Space Wing.

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